



section of the air flowing duct, and wherein the humidifying  
nozzles in one of the humidifying tubes alternate with the  
humidifying nozzles in the adjacent one of the humidifying tubes,  
whereby steam is uniformly injected to an ambient air flowing  
5 section and finely mixed.

4. The steam injection humidifier according to claim 2,  
wherein each of the humidifying nozzles has a hole which is tapered  
at an angle  $\beta$  of  $-60^\circ$  to  $+60^\circ$  .  
10

5. The steam injection humidifier according to claim 2,  
wherein each of the injection nozzles in each of the humidifying  
tubes is provided as a pressed pin type nozzle that is made through  
elasto-plastic deformation, or a screw type nozzle having a hole  
15 formed in a round-head plus screw.

6. The steam injection humidifier according to claim 2,  
wherein each of the humidifying nozzles is inwardly projected into  
each of the humidifying tubes so that condensate is downwardly  
20 exhausted to prevent condensate from being injected while being  
mixed with steam even if condensate is generated as steam is cooled  
by the ambient air.

7. The steam injection humidifier according to claim 2,

wherein each of the humidifying tubes comprises a pneumatic resistance adjustment tube projected to the upstream and downstream headers to allow adjustment of steam capacity introduced to the each humidifying tube, and wherein the each  
5 humidifying tube is rotatable to adjust the direction of injecting steam and the number of humidifying holes of the humidifying nozzles.

8. The steam injection humidifier according to claim 7,  
10 wherein the humidifying nozzles in the each humidifying tube can be detached and replaced with sealing bodies to allow adjustment of the number of the humidifying holes.

9. The steam injection humidifier according to claim 7,  
15 wherein one of the pneumatic resistance adjustment tubes of the each humidifying tube projected to the upstream header has variable penetrating depth into the upstream header to adjust pneumatic resistance to the each humidifying tube from the upstream header to the each humidifying tube for the uniform  
20 distribution of flow rate, and tapered in the upper part, whereby flowing rate of steam into the each humidifying tube at the inlet side can be adjusted by the rotation of the tapered surface.

10. The steam injection humidifier according to claim 9,





14. The steam injection humidifier according to claim 1,  
wherein each of the fastening means of each of humidifying tubes  
and the upstream header includes:

internal threads provided in the upstream header;

5 a first nut for surrounding and fixedly supporting a  
pneumatic resistance adjustment tube, the first nut having  
external threads at the upper end, a fixing threshold in the  
periphery under the threads, a hole with threads for receiving  
a headless bolt for one-point support, and a radially tapered  
10 lower end;

a ferrule for being coupled with the tapered lower end of  
the first nut;

a second nut for fixing the each humidifying tube; and

15 a connector tube having an outer diameter the same as the  
each humidifying tube and the pneumatic resistance adjustment  
tube,

wherein the first nut is inserted into the internal threads  
of the upstream header, the connector tube is coupled with the  
lower part of the first nut to connect the each humidifying tube  
20 and the pneumatic resistance adjustment tube, and the connector  
tube is coupled with the second nut to fasten the each humidifying  
tube into the upstream header.

15. The steam injection humidifier according to claim 1,  
25 wherein each of the fastening means for each of humidifying tubes

and the upstream header includes:

internal threads provided in the upstream header;

a first nut for surrounding and fixedly supporting a pneumatic resistance adjustment tube, the first nut having external threads provided in the whole periphery, grooves at both sides of a middle portion, a hole with threads for receiving a headless bolt for one-point support, and a radially tapered lower end;

a second nut for fixing the first nut;

a ferrule for being coupled with the tapered lower end of the first nut; and

a third nut for fixing the each humidifying tube,

wherein the first nut is inserted into the internal threads of the upstream header, the second nut fixes the first nut to the upstream header, the each humidifying tube is inserted into the lower part of the first nut, and the third nut is coupled to fasten the each humidifying tube into the upstream header.

16. The steam injection humidifier according to claim 1, wherein each of the fastening means for each of humidifying tubes and the downstream header includes:

```
internal threads provided in the downstream header;
```

a support baffle plate;

an opening adjustment plate;

a first nut for fixing the support baffle plate and the

opening adjustment plate, the first nut having external threads at both ends and a middle portion with reduced inside radius for stopping the each humidifying tube, the support baffle and the opening adjustment plate; and

5           a second nut for fixing a pneumatic resistance adjustment tube,

          wherein the first nut is coupled into the threads of the downstream header, the baffle plate, the opening adjustment plate and the humidifying tube are inserted into the first nut, and the  
10       second nut is coupled around the first nut to fasten the each humidifying tube to the downstream header.

17. The steam injection humidifier according to claim 1, further comprising cylindrical plugs for coupling the humidifying  
15       tubes with the upstream and downstream headers to adjust the number of the humidifying tubes in opening/shutting the passages according to required humidifying capacity.

18. The steam injection humidifier according to claim 1,  
20       wherein said humidifying tubes are thimble-type humidifying tubes each having passages therein for allowing steam to make a detour.

19. The steam injection humidifier according to claim 18, wherein each of said thimble-type humidifying tubes has a



passage-guiding insert having a U-shaped side section or an inside passage-guiding insert having an O-shaped side section within the each thimble-type humidifying tube to form passages so that nonuniformity of a steam state within the each thimble-type humidifying tube is compensated due to cooling by the ambient air to allow the steam state to be substantially uniform.

20. The steam injection humidifier according to claim 18,  
wherein each of said thimble-type humidifying tube has an outer  
tube, said outer tube generally having a geometric sectional shape  
selected from a group including a flat shape, ellipse or diamond  
to reduce resistance against an outer main flow, said outer tube  
additionally having circularly sectional end shapes where said  
thimble-type humidifying tubes are fastened to the upstream and  
downstream headers by ferrules for preventing leakage.

21. The steam injection humidifier according to claim 18,  
wherein each of said thimble-type humidifying tube has an inner  
passage-guiding insert formed to be outwardly projected in part  
and humidifying nozzles provided at one side of said inner  
passage-guiding insert.

22. A quick response steam generator, comprising:  
a housing for defining the contour of the steam generator

to feed steam to a humidifier and storing water in the lower part;

5 housing;

a number of gaps arranged in a longitudinal direction for enhancing efficiency of transferring heat from the heater to enhance responsiveness so that bubbles generated by the heater can be easily released.